Selection of Hourly Load Shapes for use in Resource Adequacy Studies - Primer

Greg Drake
Resource Adequacy

NYSRC - Installed Capacity Subcommittee

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Purpose

- Develop potential questions and outline areas for exploration in determining the selection criteria for choosing hourly shapes in RA studies.

Background

- A load shape is an hourly recording of loads in an area over a year.
  - Load shape varies from year to year, driven by factors including annual weather variability, technological innovation, public policy, and other longer term trends
- They are used in various NYISO / NYSRC planning studies, including
  - Installed Reserve Margin (NYSRC), Determination of Minimum Locational Installed Capacity Requirements (LCRs), Comprehensive System Planning Process (CSPP) and Generator Deactivation Assessments. In combination, the load shape and peak load forecast determine hourly load throughout the year in these studies.
- The MARS model compares resources available to meet the modeled loads on an hour by hour basis.
- Actual peak loads can be higher (or lower) than forecast due to weather, etc. Seven separate analyses are conducted, each with a probability of a higher or lower peak load occurring. These are called bins of load forecast uncertainty.
- Different load shapes can be used in these “bins”.

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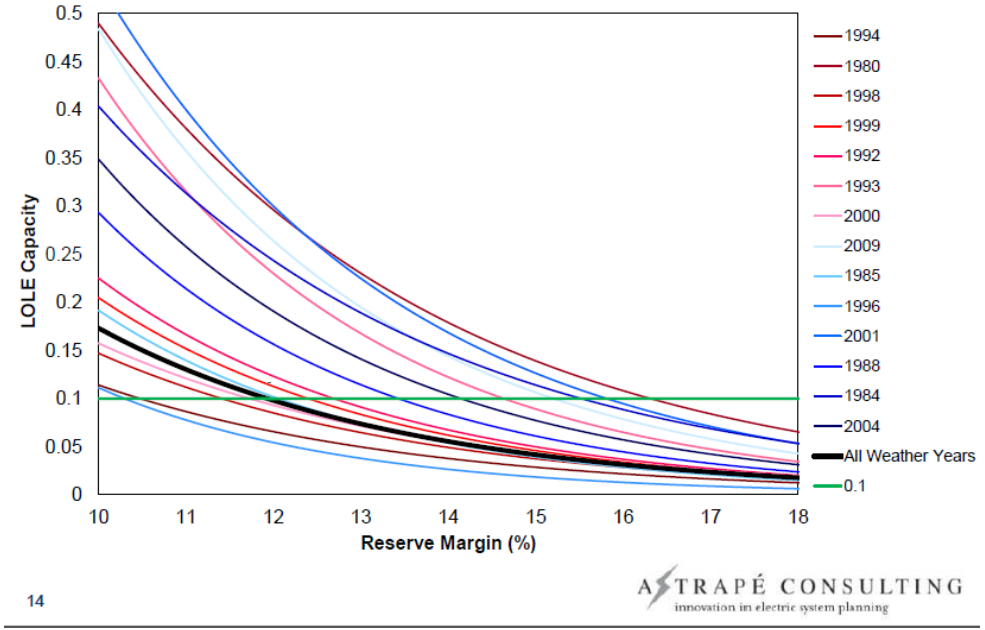
More Background

- Choice of load shapes can have a large impact on required reserve margins[1]



1. Weather Shape Impact on Resource Adequacy Analysis, Kevin Carden, Astrapé Consulting. http://www.nerc.com/pa/RAPA/Workshops_DL/Probabilistic_Fundamentals_Workshop_Presentations_December_2017.pdf

More Background

- In the example study, load shape caused the required reserve margin to vary between 10.5% and 16.5%[2]

Reserve Margin for 0.1 LOLE Capacity

Weather Year	Reserve Margin for 0.1 LOLE Cap (%)
1980	16.50
1984	15.75
1985	12.25
1988	13.50
1992	12.75
1993	14.75
1994	10.50
1996	10.50
1998	11.50
1999	12.50
2000	11.75
2001	16.00
2004	14.25
2009	15.25
All Weather Years	12.00

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ASTRAPÉ CONSULTING
innovation in electric system planning

2. ibid.

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To Date

- **Two metrics were evaluated in a previous paper [1]**
  - Magnitude; measured as the actual peak divided by the weather normalized peak
  - Duration; measured as the top 30 daily peaks divided by the actual peak and then averaged

1. *Modeling Multiple Load Shapes in Resource Adequacy Studies*, NYISO, June 19, 2013, - paper attached to 2014 IRM Study report available on NYSRC.org

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The Need (Drivers)

- **Change from studying daily peaks to 8760**
  - Modeling of forecast system energies becomes more important
- **System Characteristics are rapidly changing**
  - Older load shapes may not capture recent trends
  - Dramatic increase in load modifying resources such as distributed resources, renewables, and/or storage.

Task #1

- **Driven by risk generated from studying all 8760 hours instead of daily peaks**
  - Examine correlation between metrics – peak load and duration of peak load
  - Will need to re-evaluate previous 2nd metric, Duration

Task #2

- **Driven by risk generated from studying all 8760 hours instead of daily peaks-** ***continued***
  - Find out if yearly energies are critical in LS selection
  - Analyze whether the probabilities of certain load shapes can match the probabilities associated with the LFU bins

Tasks # 3 and # 4

- How do consecutive high load days compare with high load days that are scattered
  - Is there a trend in recent years to sustained heat waves. Does latent heat build up affect risk
- As more renewable resources come on-line, are the characteristics of the load shapes changed and should they be examined post renewable effects.

Tasks # 5 and # 6

- If we find that one load shape creates risk over the top 50 hours and another creates risk over 75 hours should this characteristic be used to separate shapes into bins
- What do other ISOs/RTOs consider in load shape selection for their studies.

NYISO Proposal – 2018 work

- Provide additional review of load shapes to ICS, as necessary
- Work with ICS to develop potential research questions

2018 Schedule

- Load shape data collection and routine adjustments-5/18
- Find total hours of LOLE risk-6/18
- Begin examination of potential characteristics-9/18
- Develop scope of work to complete selection criteria and additional needed work-10/18

Questions?

We are here to help. Let us know if we can add anything.

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